TransHab passes critical test

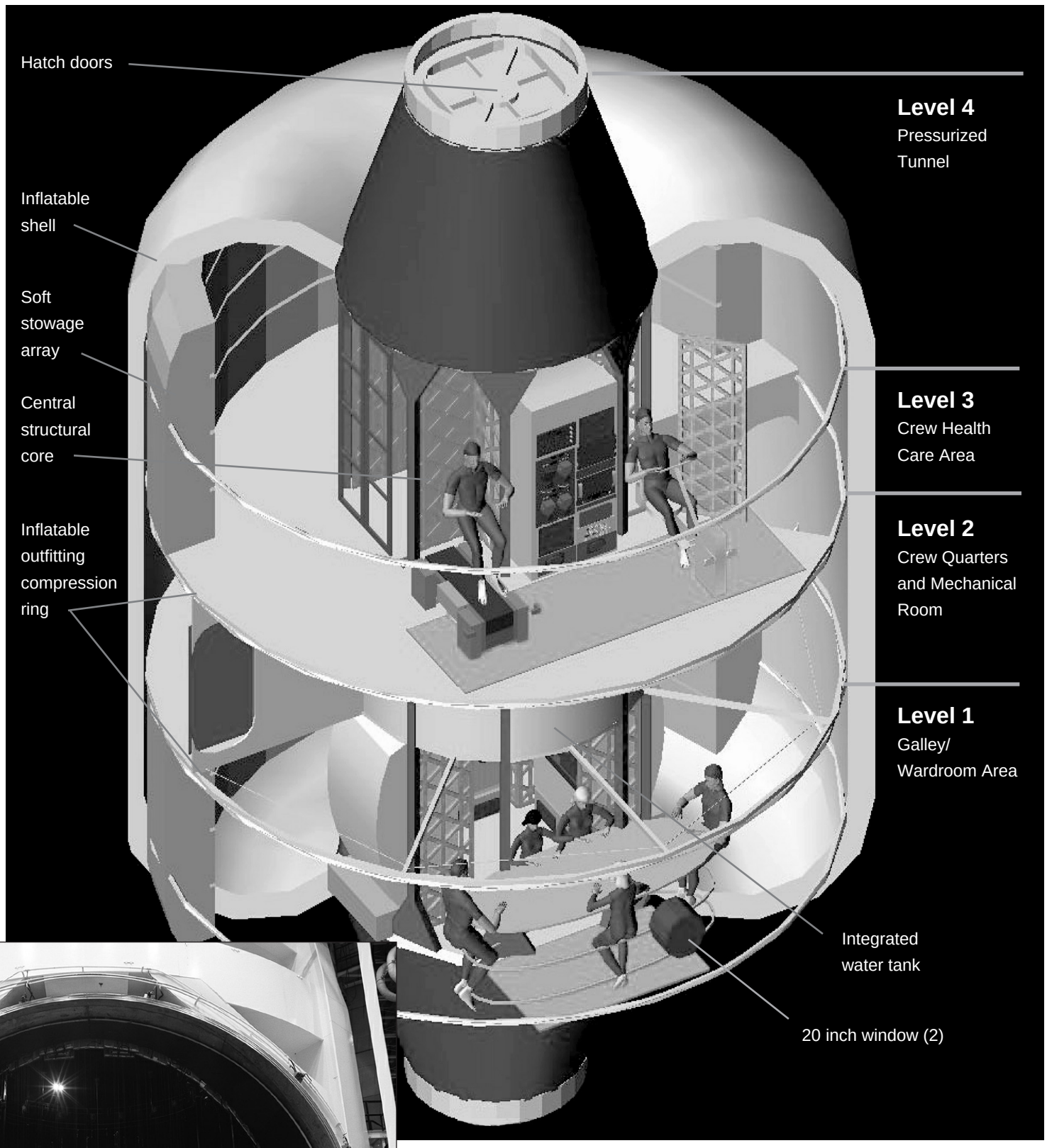
JSC's Engineering Directorate successfully demonstrated the deployment and inflation of an inflatable spacecraft known as TransHab by testing the full-scale TransHab test article on December 21, 1998, in JSC's Space Simulation Chamber A.

The December test was the final in a series of tests conducted in 1998 to demonstrate the feasibility of an inflatable structure. Two earlier units were hydrostatically tested at JSC's Neutral Buoyancy Laboratory, demonstrating the structural integrity of the fabric structure to a safety factor of four atmospheres (no aluminum space module has done this). This is the first time tests of this kind have been conducted, and this activity has generated interest from around the world.

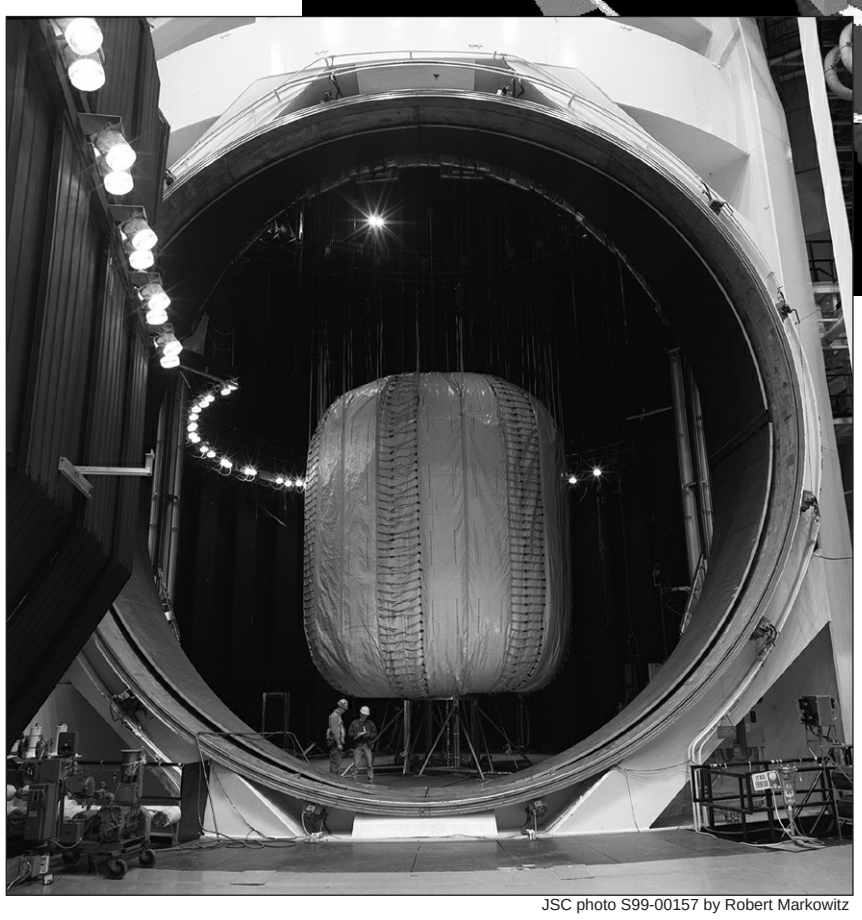
The project began in the spring of 1997 when Leonard Nicholson, director of the Engineering Directorate, challenged engineers to find a way to develop a lighter, cheaper spacecraft for manned missions to Mars. Initially, a small group, led by Dr. William C. Schneider, developed the TransHab concept with something added to it – a proposal to the agency for JSC to build a full-scale unit and demonstrate the feasibility of the technology. Once TransHab was turned into a project, the TransHab team, led by JSC engineer Donna Fender, was formed. This group was ultimately challenged to design and build a full-scale structural test article to demonstrate the ability to manufacture, assemble, package, and deploy the inflatable module in a space simulation chamber, in addition to verifying the overall structural capability of the inflatable concept, all in 1998.

The resulting 3-stories-tall inflatable module concept, TransHab, offers significant advantages as a general purpose habitation module. It has been proposed to the International Space Station program as a replacement for the current baseline habitation module. "The TransHab project is a perfect example of the kind of technical innovation it will take to make exploration affordable and real," said Nicholson. "Furthermore, consideration of TransHab for ISS application represents the kind of vision across programs that is also a key element of enabling exploration, plus it will make the space station a more productive place to live and work. The skill, energy, and dedication demonstrated by the team that has brought the TransHab design so far in such a short period of time tells me that our people are indeed ready to make new things happen."

The general structural configuration of TransHab consists of an outer multi-layer inflatable shell (over a foot thick) and a hard central structural core. The multi-layer shell consists of a redundant bladder assembly, a woven Kevlar restraint assembly, a meteoroid and orbital debris protection shield, and a multi-layer thermal insulation blanket.



Internal configuration of International Space Station TransHab



JSC photo S99-00157 by Robert Markowitz

A full-scale TransHab undergoes vacuum testing in JSC's Space Simulation Chamber A.

The one-foot-thick TransHab meteoroid and orbital debris protection shield is capable of protecting against larger debris than standard hypervelocity shield concepts. The TransHab team has successfully demonstrated the protection provided by the MOD shield with particles up to 1.7 cm diameter at speeds of 7 km/s (15,000 mph).

The 11-foot diameter central core, running the full length of the module's interior, houses the crew quarters. The crew quarters are surrounded by a water jacket (known as the storm shelter) affording the crew additional protection during solar particle events. At 27 feet in diameter and 35 feet in length, TransHab's dimensions make its volume three times larger than a standard module and would double the entire ISS stowage capacity. The 3-level module would give astronauts a homelike environment for long-duration missions, including six private crew quarters, a medical health and exercise area, hygiene facility, storage, galley, and wardroom equipped with a table capable of seating up to 12 persons, easily accommodating an entire ISS crew and a shuttle changeover crew simultaneously.

JSC photo S98-14600

Donna Fender, program manager, JSC TransHab Project Office, holds a piece of the Kevlar material used to build the module.

This hybrid inflatable and central core structure is light and compact enough to be launched by the shuttle. The TransHab is collapsed and secured by a restraint system in a 14-foot diameter package for launch in the shuttle payload bay. When on orbit, the packaged TransHab module would then be removed from the shuttle payload bay, docked to an element (like space station) and deployed by releasing the restraint. Once released, the TransHab would be inflated to its operational pressure, resulting in a 27-foot diameter module. Then the subsystems stored on structural shelves in the central core will be repositioned to the appropriate internal configuration.

The TransHab team is currently working with ISS to provide technical and management data needed for the habitation module design selection decision. The decision is expected to occur in the February/March time frame. ■